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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/964,763	09/27/2001	Arch D. Robison	042390.P11908	2972

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EXAMINER	
YIGDALL, MICHAEL J	

ART UNIT	PAPER NUMBER
2122	

DATE MAILED: 07/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/964,763	ROBISON, ARCH D.
	Examiner	Art Unit
	Michael J. Yigdall	2122

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *6 May 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This Office action is in reply to Applicant's response and amendment dated May 6, 2004. Claims 1-26 remain pending.

Response to Arguments

2. Applicant's arguments have been fully considered but they are not persuasive.

Applicant contends that neither Archambault nor Blainey disclose or suggest receiving a code segment having a plurality of instructions including a number of pointers wherein at least one of the pointers is a restricted pointer (see page 10).

However, Archambault discloses receiving a code segment that includes a plurality of pointer instructions, such as pointer variable definitions, and determining sets of aliases among the pointers (see column 5, lines 4-17). Archambault further discloses that the alias sets are made precise such as to improve optimization in a compiler (see column 3, lines 12-18).

Blainey discloses that precise alias information can be obtained from language rules, language features, and assertions made by the programmer (see column 2, lines 40-46). Blainey, like Archambault, discloses that alias information is used for optimization in a compiler (see column 3, lines 26-29).

Blainey discloses examples of such language features and programmer assertions that relate to pointers and memory access (see column 2, lines 40-46). Another comparable language feature is, for example, restricted pointers.

Robison, in "Restricted Pointers Are Coming" (art of record), discloses the *restrict* keyword and its use as an assertion in pointer declarations (see the "Restrict Qualifies Pointers"

section). Robison further discloses that restricted pointers address problems associated with aliases and improve the performance of programs written in the C and C++ languages (see the "FORTRAN Envy" and "Conclusion" sections).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made for the Archambault system to employ language rules, language features and programmer assertions to precisely determine aliases and alias sets, as taught by Blainey, including the language feature of restricted pointers disclosed by Robison, for the purpose of improving optimization and performance.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pat. No. 6,173,444 to Archambault in view of U.S. Pat. No. 6,045,585 to Blainey in view of "Restricted Pointers are Coming" by Robison.

With respect to claim 1 (currently amended), Archambault discloses a method comprising:

(a) receiving a code segment having a plurality of instructions, the code segment having an outer scope and a number of inner scopes, wherein the plurality of instructions comprise a number of pointers (see column 5, lines 4-17, which shows receiving program code having a number of functions, i.e. a number of inner scopes within the outer scope of the program, and a plurality of instructions comprising a number of pointers).

Although Archambault discloses pointer variables in the C programming language (see column 4, lines 13-15) and using precise alias sets to improve optimization (see column 3, lines 12-18), Archambault does not expressly disclose the limitation wherein at least one of the number of pointers is a restricted pointer.

However, Blainey discloses obtaining precise alias information with language rules, language features and programmer assertions (see column 2, lines 40-46), in a system for program optimization in a compiler (see column 3, lines 26-29). Note that restricted pointers are considered an example of such language features that enable assertions by the programmer.

Moreover, Robison discloses restricted pointers as a language feature that enables an assertion to be made with regard to aliases for improving performance (see the "FORTRAN Envy," "Restrict Qualifies Pointers" and "Conclusion" sections).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for the Archambault system to employ language rules, language features and programmer assertions to precisely determine aliases and alias sets, as taught by Blainey, including the language feature of restricted pointers disclosed by Robison, for the purpose of improving optimization and performance.

Archambault further discloses:

(b) determining, within one of the number of inner scopes, whether at least two pointers of the number of pointers are aliases (see column 5, lines 4-17, which shows building an alias graph for each function or scope by determining the alias sets of the pointers, i.e. by determining whether the pointers are aliases).

With respect to claim 2 (original), Archambault further discloses determining a base pointer for each pointer of the number of pointers (see column 5, lines 4-17, which shows determining a base pointer for each pointer definition comprising the right-hand side of its associated variable assignment operation).

With respect to claim 3 (original), Archambault further discloses the limitation wherein the determining a base pointer for each pointer of the number of pointers comprises grouping pointers together upon determining that the pointers are copied to a pointer that is not a restricted pointer (see column 6, lines 16-46, which shows finding the union of alias sets and propagating transitive relationships to group pointers together, when appropriate, such as when pointers are copied to a non-restricted pointer).

With respect to claim 4 (original), Archambault further discloses the limitation wherein there is no grouping of pointers when the pointers have distinct base pointers (see column 5, lines 31-41, which shows adding new nodes to the pointer graph, i.e. not grouping the pointers into an alias set, when the base pointers are distinct and thus not already represented in the graph).

With respect to claim 5 (original), Archambault further discloses, for each instruction of the plurality of instructions that accesses a pointer, determining which at least one restricted pointer is within the scope of the pointer when the pointer is accessed (see column 5, lines 52-56, which shows determining the pointer variables accessed in the local scope).

With respect to claim 6 (original), Archambault further discloses the limitation wherein the determining, within one of the number of inner scopes, whether at least two pointers of the number of pointers are aliases is based on the base pointer for each of the number of pointers (see column 6, lines 61-67, which shows that alias sets are determined based on the L-value, i.e. the memory address or base pointer).

With respect to claim 7 (original), Archambault further discloses the limitation wherein the determining, within one of the number of inner scopes, whether at least two pointers of the number of pointers are aliases is based on, for each instruction of the plurality of instructions that accesses the pointer, which at least one restricted pointer is within the scope of the pointer, when the pointer is accessed (see column 5, lines 52-56, which shows determining the alias sets for all pointer variables accessed in the local scope).

With respect to claim 8 (currently amended), Archambault discloses a method comprising:

(a) receiving a code segment having a plurality of instructions, wherein the plurality of instructions comprise a number of pointers (see column 5, lines 4-17, which shows receiving program code having a plurality of instructions comprising a number of pointers).

Although Archambault discloses pointer variables in the C programming language (see column 4, lines 13-15) and using precise alias sets to improve optimization (see column 3, lines 12-18), Archambault does not expressly disclose the limitation wherein at least one of the number of pointers is a restricted pointer.

However, Blainey discloses obtaining precise alias information with language rules, language features and programmer assertions (see column 2, lines 40-46), in a system for program optimization in a compiler (see column 3, lines 26-29). Note that restricted pointers are considered an example of such language features that enable assertions by the programmer.

Moreover, Robison discloses restricted pointers as a language feature that enables an assertion to be made with regard to aliases for improving performance (see the "FORTRAN Envy," "Restrict Qualifies Pointers" and "Conclusion" sections).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for the Archambault system to employ language rules, language features and programmer assertions to precisely determine aliases and alias sets, as taught by Blainey, including the language feature of restricted pointers disclosed by Robison, for the purpose of improving optimization and performance.

Archambault further discloses the limitation wherein the at least one restricted pointer is in-scope or out-of-scope (see column 5, lines 18-23 and 52-56, which show different levels of scope; note that a pointer would be considered either in or out of scope); and

(b) determining whether at least two pointers of the number of pointers are aliases when each pointer of the at least two pointers is out-of-scope relative to the other pointers of the at least two pointers (see column 5, lines 4-17, which shows determining whether pointers are aliases by defining the alias sets of pointers in a given function or scope, i.e. of pointers that are out of scope relative to other pointers).

With respect to claim 9 (original), Archambault further discloses determining a base pointer for each pointer of the number of pointers (see column 5, lines 4-17, which shows

determining a base pointer for each pointer definition comprising the right-hand side of its associated variable assignment operation).

With respect to claim 10 (original), Archambault further discloses determining, for each pointer of the number of pointers, whether each at least one restricted pointer is in-scope when the pointer of the number of pointers is accessed (see column 5, lines 52-56, which shows determining the pointer variables accessed in the local scope).

With respect to claim 11 (original), Archambault further discloses the limitation wherein the determining whether at least two pointers of the number of pointers are aliases is based on determining a base pointer for each pointer of the number of pointers (see column 6, lines 61-67, which shows that alias sets are determined based on the L-value, i.e. the memory address or base pointer).

With respect to claim 12 (original), Archambault further discloses the limitation wherein the determining whether at least two pointers of the number of pointers are aliases is based on determining a base pointer for each pointer of the number of pointers (see column 6, lines 61-67, which shows that alias sets are determined based on the L-value, i.e. the memory address or base pointer), and on determining for each pointer of the number of pointers whether each at least one restricted pointer is in-scope when the pointer is accessed (see column 5, lines 52-56, which shows determining the pointer variables accessed in the local scope).

With respect to claim 13 (currently amended), see the explanation for claim 1 set forth above. Claim 13 is a system claim that recites limitations analogous to those recited in method

claim 1. Note that Archambault further discloses a compiler coupled to a memory unit (see column 3, lines 12-18).

With respect to claim 14 (original), see the explanation for claim 2 set forth above.

With respect to claim 15 (original), see the explanation for claim 5 set forth above.

With respect to claim 16 (original), see the explanation for claim 7 set forth above.

With respect to claim 17 (currently amended), see the explanation for claim 1 set forth above. Claim 17 is a product claim that recites limitations analogous to those recited in method claim 1. Note that Archambault further discloses a machine-readable medium that provides instructions to be executed by a machine (see column 3, lines 36-40).

With respect to claim 18 (original), see the explanation for claim 2 set forth above.

With respect to claim 19 (original), see the explanation for claim 5 set forth above.

With respect to claim 20 (original), see the explanation for claim 6 set forth above.

With respect to claim 21 (original), see the explanation for claim 7 set forth above.

With respect to claim 22 (currently amended), see the explanation for claim 8 set forth above. Claim 17 is a product claim that recites limitations analogous to those recited in method claim 8. Note that Archambault further discloses a machine-readable medium that provides instructions to be executed by a machine (see column 3, lines 36-40).

With respect to claim 23 (original), see the explanation for claim 9 set forth above.

With respect to claim 24 (original), see the explanation for claim 10 set forth above.

With respect to claim 25 (original), see the explanation for claim 11 set forth above.

With respect to claim 26 (original), see the explanation for claim 12 set forth above.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Yigdall whose telephone number is (703) 305-0352. The examiner can normally be reached on Monday through Friday from 7:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on (703) 305-4552. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MY

Michael J. Yigdall
Examiner
Art Unit 2122

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WEI Y. ZHEN
PRIMARY EXAMINER